



## Criminalistics Section – 2005

### B113 Effects of Aging on Pressure Sensitive Tape Analysis: A Preliminary Study

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The goal of this presentation is to present preliminary results on how accelerated aging and prolonged exposure to moderate heat affect the IR spectra of the backing and adhesive layer of tapes, as well as microspectrophotometry of the backing.

The comparison of tapes to database information and standards often involves the use of IR spectra of the backing and adhesive, as well as MSP of the backing. This presentation will impact the forensic community and/or humanity by showing the importance of considering how exposure to different environments can affect these features.

Forensic tape analysis involves either attempting to match two pieces of tape or attempting to identify a tape by comparing it to standards in a database. Parameters contained in the database include a number of physical features and chemical properties.

Physical features include functions of dimensions and morphology, which are not necessarily stable when the tape is taken off the roll and applied. More stable and objective measurements such as determination of the components of the backing and adhesive, as well as MSP measurement of the color of the backing, have been proposed to add more stable dimensions to the databases. IR spectra of the backing and adhesive have been proposed in order to identify the components of the backing and adhesive layers. However, both the polymers and additives used in pressure sensitive tape backings and adhesives degrade when exposed to a number of factors such as oxygen, humidity, mechanical stress, aggressive media and ionizing radiation and temperature. This degradation has the potential of altering the appearance of the IR and MSP spectra.

A selection of tapes was obtained, including office, duct, electrical and packing tapes. The backing layers were analyzed by ATR-FTIR and MSP, and the adhesive layers by DRIFTS. One set of tapes was then exposed to moderately heat in an oven set to 55°C and another to accelerated aging according to the ISO 4892-2 standard. The tapes were attached to two different plastic films, PVDC and LLD-PE. Spectra of the backing and adhesives were then obtained by ATR-FTIR and DRIFTS and compared to those of the unexposed tape.

The main polymer component of the spectra did not change significantly, but noteworthy changes were observed in smaller peaks that could be used to differentiate between tapes of the same base polymer but different manufacturers. As expected, not all types or brands of tapes reacted similarly to the environmental exposure. In addition, some changes in the adhesive spectra appear to be influenced by the substrate the tape was deposited on during its exposure to heat or weathering. Only one set of tapes was exposed to each of the environments, and only one set of analyses performed on each sample, so the results would have to be confirmed by a more comprehensive study.

More work needs to be done to validate and further define these results, but it seems clear that effects from exposure to different environments, and potentially substrate effects should be taken into consideration when analyzing pressure sensitive tapes.

**Pressure Sensitive Tape, IR, Database**